1.0 POLICY

It is the policy of the California State University, Sacramento (Sac State) to provide its employees with a safe and healthful workplace. To reduce or eliminate the dangers associated with the use of electrical energy, the campus complies with California Occupational Health and Safety Administration (Cal/OSHA) regulations, the intent of National Fire Protection Association (NFPA) 70E, the National Electrical Code (NEC), and other established safety standards.

2.0 PURPOSE

The purpose of this document is to provide guidance in the performance of work on electrical systems, wiring, and equipment when working on or near live parts or when making any modifications to a campus building electrical system (wiring or equipment).

Reading this document does not qualify the reader to perform electrical work. Guidelines that are beyond the scope of this document must be established at each work area. They should include, as a minimum, the safety concerns outlined in this document.

3.0 SCOPE

This document applies to all electrical conductors and equipment operating at 50 volts nominal, or greater. This document also applies to live parts operating at less than 50 volts nominal, if there is an increased risk of exposure to electrical burns or to explosion due to electrical arcs.

4.0 RESPONSIBILITIES

The following persons / entities have responsibilities as delineated below for implementation of this document:

4.1 Office of Environmental Health and Safety

It is the responsibility of the Office of Environmental Health and Safety (EH&S) to:

a) Maintain and update this Document as necessary.

b) Provide consultation to Deans, Directors, Chairpersons, coordinators, Principal Investigators, managers, and supervisors regarding program compliance. EH&S can provide consultation on such issues as: hazard identification and evaluation; procedures for correcting unsafe conditions; systems for communicating with employees; employee training programs; compliance strategies; and record keeping.

c) Develop and implement an education and training program designed to instruct employees in safe work practices related to preventing injuries and illnesses from electrical hazards.

4.2 Vice Presidents and Program Center Administrators, Department Heads, Chairs and Managers

Vice Presidents and Program Center Administrators, Department Heads, and Managers are responsible to:

a) Develop and maintain written departmental procedures as necessary and ensure that each supervisor adheres to adopted procedures.

b) Develop and implement an education and training program designed to instruct employees in safe work practices related to preventing injuries and illnesses from electrical hazards.

c) Provide necessary safety equipment, including personal protective equipment designed to prevent electrical and arc flash injuries, to employees, at no cost to the employee.

4.3 Supervisors & Lead Personnel

Supervisors & Lead Personnel are responsible to:

a) Develop workplace procedures to ensure effective compliance with this and other Safety Procedures.

b) Ensure that each employee adheres to adopted procedures.

c) Instruct employees in the recognition and avoidance of unsafe conditions. Ensure that newly hired, newly assigned or reassigned employees are properly trained in all safety procedures associated with their new duties.

d) Assure that personal protective equipment is tested and certified in accordance with recommendations and/or the ANSI and ASTM referenced in sections 130.7(C)(8) and 130.7(F) of NFPA 70E.

4.4 Employees

All employees are required to;

a) Read and comply with procedures and guidelines provided by their supervisors.

b) Inform their supervisors of workplace hazards without fear of reprisal.

c) Attend established education and training sessions; understand and comply with all applicable safety requirements. Failure to comply with established safety rules may be reflected in performance evaluations and may lead to disciplinary action consistent with procedures described in respective collective bargaining contracts, where applicable.

d) Ask questions of their supervisors when there is concern about an unknown or potentially hazardous situation.

5.0 APPROVED WORKERS

Only persons specifically approved by the Director of Facilities & Utilities may install, modify, repair, or work on electrical conductors and equipment in or on Sac State facilities. Authorization is hereby granted to employees in the following classifications, on the condition that the employee has completed the minimum training requirements in electrical safety:

Electrician	Lead Electrician	Supervising Electrician
Building Service Engineer	Refrigeration Mechanic	Facilities Control Specialist
Facility Worker 1	Facility Worker 2	Maintenance Mechanic
Supervising Building Service Engineer		

Training Requirement	Target Audience	Frequency	Trainer
General Electrical Safety Training	Unqualified employees	At the time of initial employment	Environmental Health and Safety
Lockout/Tagout Training	Employees who work directly with electrical systems from 50 to >600 volts, Authorized Lockout/Tagout Persons	At the time of initial employment	Supervisor or Environmental Health and Safety
Arc Flash Protection	Employees who work directly wit electrical systems from 50 to > 600 volts	At the time of initial employment	Qualified High Voltage Trained Technician
High Voltage and Hazardous Electrical Safety Training	Employees who work with, or in the proximity of, electrical equipment or systems over 600 volts, Qualified Electrical Worker	At the time of initial employment	Qualified High Voltage Trained Technician

Any non-University employee performing work on electrical conductors and equipment must be working under a licensed contractor holding a valid C-10 license issued by the State of California and working under an approved Building Permit or contract issued by Facility Services.

EXCEPTION: Properly trained employees may work on department-owned electrically powered equipment (such as power tools, machines, computers, etc.) which has been disconnected from the building electrical system by one of the following means:

a) Disconnection of the attachment plug from the receptacle.

b) Reduction of the equipment to a zero energy state by following the equipment specific lock-out tag-out (LOTO) procedure for the device. The campus LOTO procedure must be followed and this lockout may ONLY be performed by an approved worker.

6.0 APPROACH BOUNDARIES TO LIVE PARTS (NFPA 70E, 130.2)

6.1 Trained Employees

A properly trained employee shall not approach or take any conductive object closer to exposed live parts (operating at 50 volts or more) than the Restricted Approach Boundary listed in Table 1 (below) unless ANY of the following apply:

(1) The properly trained employee is insulated or guarded from the live parts operating at 50 volts or more and no uninsulated part of the employee's body crosses the Prohibited Approach Boundary listed in Table 1.

(2) The live part operating at 50 volts or more is insulated from the employee and from any other conductive object at a different potential.

Table 1. Approach boundaries to live parts for shock prevention

	Limited approach boundary			
Nominal system voltage range, phase to phase	**Exposed movable conductor**	**Exposed fixed- circuit part**	**Restricted approach boundary (allowing for accidental movement)**	**Prohibited approach boundary**
0 to 50 volts	Not specified	Not specified	Not specified	Not specified
51 to 300 volts	10 ft. 0 in.	3 ft. 6 in.	Avoid contact	Avoid contact
301 to 750 volts	10 ft. 0 in.	3 ft. 6 in.	1 ft. 0 in.	0 ft. 1 in.
751 to 15,000 volts	10 ft. 0 in.	5 ft. 0 in.	2 ft. 2 in.	0 ft. 7 in.

6.2 Untrained Person

When an untrained person is working at or close to the Limited Approach Boundary, the supervisor in charge of the job shall advise the untrained person of the electrical hazard.

7.0 WORKING ON OR NEAR LIVE PARTS

7.1 Justification for Work.

Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless the employer can **demonstrate that de-energizing introduces additional or increased hazards or is infeasible** due to equipment design or operational limitations. Energized parts that operate at less than 50 volts to ground shall not be required to be de-energized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

Examples of increased or additional hazards include, but are not limited to, interruption of life support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment.
Examples of work that might be performed on or near exposed energized electrical conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing diagnostics and testing (e.g., start-up or troubleshooting) of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

7.2 Energized Electrical Work Permit

(1) Where Required. If live parts are not placed in an electrically safe work condition (i.e., for the reasons of increased or additional hazards or infeasibility per 7.1), work to be performed shall be considered energized electrical work and shall be performed by written permit only. A copy of the work permit is located in Appendix B.

(2) Elements of Work Permit. The energized electrical work permit shall include the following items:

(1) A description of the circuit and equipment to be worked on and their location
(2) Justification for why the work must be performed in an energized condition
(3) A description of the safe work practices to be employed
(4) Results of the shock hazard analysis
(5) Determination of shock protection boundaries
(6) Results of the flash hazard analysis
(7) The Flash Protection Boundary
(8) The necessary personal protective equipment to safely perform the assigned task
(9) Means employed to restrict the access of unqualified persons from the work area
(10) Evidence of completion of a job briefing, including a discussion of any job-specific hazards
(11) Energized work approval signatures (responsible supervisor, Facility Services manager, or Risk Management representative).

Exemptions to Work Permit. Work performed on or near live parts by qualified persons related to tasks such as testing, troubleshooting, voltage measuring, etc., shall be permitted to be performed without an energized electrical work permit, provided appropriate safe work practices and personal protective equipment in accordance with this procedure are provided and used.

7.3 Flash Hazard Analysis

A flash hazard analysis shall be done in order to protect personnel from the possibility of being injured by an arc flash. The analysis shall determine the Flash Protection Boundary and the personal protective equipment that people within the Flash Protection Boundary shall use.

(A) Flash Protection Boundary. For systems that are 600 volts or less, the Flash Protection Boundary shall be 4.0 ft, based on the product of clearing times of 6 cycles (0.1 second) and the available bolted fault current of 50 kA or any combination not exceeding 300 kA cycles (5000 ampere seconds). For clearing times and bolted fault currents other than 300 kA cycles, or under engineering supervision, the Flash Protection Boundary shall alternatively be permitted to be calculated in accordance with the following general formula:

$$D_c = [2.65 \times MVA_{bf} \times t]^{1/2} \text{ Or } D_c = [53 \times MVA \times t]^{1/2}$$

Where: D_c= distance in feet from an arc source for a second-degree burn
MVA_{bf}= bolted fault capacity available at point involved (in mega volt-amps)
MVA = capacity rating of transformer (mega volt-amps). For transformers with MVA ratings below 0.75 MVA, multiply the transformer MVA rating by 1.25.
t = time of arc exposure (in seconds).

At voltage levels above 600 volts, the Flash Protection Boundary is the distance at which the incident energy equals 5 J/cm2 (1.2 cal/cm2). For situations where fault clearing time is 0.1 second (or faster), the Flash Protection Boundary is the distance at which the incident energy level equals 6.24 J/cm2(1.5 cal/cm2).

(B) Protective Clothing and Personal Protective Equipment for Application with a Flash Hazard Analysis.

Where it has been determined that work will be performed within the Flash Protection Boundary, the flash hazard analysis shall determine, and the supervisor shall document, the incident energy exposure of the worker (in calories per square centimeter). The incident energy exposure level shall be based on the working distance of the employee's face and chest areas from a prospective arc source for the specific task to be performed. Flame-resistant (FR) clothing and personal protective equipment (PPE) shall be used by the employee based on the incident energy exposure associated with the specific task. Recognizing that incident energy increases as the distance from the arc flash decreases, additional PPE shall be used for any parts of the body that are closer than the distance at which the incident energy was determined. As an alternative, the PPE requirements of 7.4 shall be permitted to be used in lieu of the detailed flash hazard analysis approach described in 7.3(A).

7.4 Personal and Other Protective Equipment.

(A) General. Employees working in areas where electrical hazards are present shall be provided with, and shall use, protective equipment that is designed and constructed for the specific part of the body to be protected and for the work to be performed.

(B) Care of Equipment. Protective equipment shall be maintained in a safe, reliable condition. The protective equipment shall be visually inspected before each use and tested or recertified in accordance with manufacturers recommendations and the ANSI and ASTM standards referenced in sections 130.7(C)(8) and 130.7(F) of NFPA 70E.

(C) Personal Protective Equipment.

(1) General. When an employee is working within the Flash Protection Boundary he/she shall wear protective clothing and other personal protective equipment in accordance with section 7.3.
(2) Movement and Visibility. When flame-resistant (FR) clothing is worn to protect an employee, it shall cover all ignitable clothing and shall allow for movement and visibility.
(3) Head, Face, Neck, and Chin Protection. Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with live parts or from flying objects resulting from electrical explosion.
Employees shall wear nonconductive protective equipment for the face, neck, and chin whenever there is a danger of injury from exposure to electric arcs or flashes or from flying objects resulting from electrical explosion.
(4) Eye Protection. Employees shall wear protective equipment for the eyes whenever there is danger of injury from electric arcs, flashes, or from flying objects resulting from electrical explosion.
(5) Body Protection. Employees shall wear FR clothing wherever there is possible exposure to an electric arc flash above the threshold incident-energy level for a second-degree burn, 5 J/cm2 (1.2 cal/cm2).

Exception: For incident-energy exposures 8.36 J/cm2 (2 cal/cm2) and below, employees may wear non-melting clothing described in Hazard/Risk Category 0 in NFPA 70E, Article 130 Table 130.7(C)(11).

(6) Hand and Arm Protection. Employees shall wear rubber insulating gloves where there is danger of hand and arm injury from electric shock due to contact with live parts. Hand and arm protection shall be worn where there is possible exposure to arc flash burn. The apparel described in 7.4(C)(13)(c) shall be required for protection of hands from burns. Arm protection shall be accomplished by apparel described in 7.4(C)(5).

(7) Foot and Leg Protection. Where insulated footwear is used as protection against step and touch potential, dielectric overshoes shall be required. Insulated soles shall not be used as primary electrical protection.

(8) Standards for Personal Protective Equipment. Personal protective equipment shall conform to the standards given in Table 130.7(C)(8) of NFPA 70E.

(9) Selection of Personal Protective Equipment. When selected in lieu of the flash hazard analysis of 7.3(A), *NFPA 70E, Article 130 Table 130.7(C)(9)(a)* shall be used to determine the hazard/risk category for a task. The assumed short-circuit current capacities and fault clearing times for various tasks are listed in the text and notes. For tasks not listed or for power systems with greater than the assumed short-circuit current capacity or with longer than the assumed fault clearing times, a flash hazard analysis shall be required in accordance with 7.3.

(10) Protective Clothing and Personal Protective Equipment Matrix.
Once the Hazard/Risk Category has been identified, *NFPA 70E, Article 130 Table 130.7(C)(9)* shall be used to determine the required personal protective equipment (PPE) for the task. This clothing and equipment shall be used when working on or near energized equipment within the Flash Protection Boundary.

(11) Factors in Selection of Protective Clothing. Clothing and equipment that provide worker protection from shock and arc flash hazards shall be utilized. Clothing and equipment required for the degree of exposure shall be permitted to be worn alone or integrated with flammable, nonmelting apparel. If FR clothing is required, it shall cover associated parts of the body as well as all flammable apparel while allowing movement and visibility. All personal protective equipment shall be maintained in a sanitary and functionally effective condition. Personal protective equipment items will normally be used in conjunction with one another as a system to provide the appropriate level of protection.
Note: Protective clothing includes shirts, pants, coveralls, jackets, and parkas worn routinely by workers who, under normal working conditions, are exposed to momentary electric arc and related thermal hazards. Flame-resistant rainwear worn in inclement weather is included in this category of clothing.

(a) **Layering**. Nonmelting, flammable fiber garments shall be permitted to be used as under layers in conjunction with FR garments in a layered system for added protection. If nonmelting, flammable fiber garments are used as under layers, the system arc rating shall be sufficient to prevent break open of the innermost FR layer at the expected arc exposure incident energy level to prevent ignition of flammable under layers.

(b) **Outer Layers**. Garments worn as outer layers over FR clothing, such as jackets or rainwear, shall also be made from FR material.

(c) **Under layers**. Meltable fibers such as acetate, nylon, polyester, polypropylene, and spandex shall not be permitted in fabric under layers (underwear) next to the skin.

(d) **Coverage**. Clothing shall cover potentially exposed areas as completely as possible. Shirt sleeves shall be fastened at the wrists, and shirts and jackets shall be closed at the neck.

(e) **Fit.** Tight-fitting clothing shall be avoided. Loose- fitting clothing provides additional thermal insulation because of air spaces. FR apparel shall fit properly such that it does not interfere with the work task.

(f) **Interference**. The garment selected shall result in the least interference with the task but still provide the necessary protection. The work method, location, and task could influence the protective equipment selected.

(13) Arc Flash Protective Equipment.

(a) **Flash Suits**. Flash suit design shall permit easy and rapid removal by the wearer. The entire flash suit, including the hood's face shield, shall have an arc rating that is suitable for the arc flash exposure. When exterior air is supplied into the hood, the air hoses and pump housing shall be either covered by FR materials or constructed of nonmelting and nonflammable materials.

(b) **Face Protection**. Face shields shall have an arc rating suitable for the arc flash exposure. Face shields without an arc rating shall not be used. Eye protection (safety glasses or goggles) shall always be worn under face shields or hoods.

Note: Face shields made with energy-absorbing formulations that can provide higher levels of protection from the radiant energy of an arc flash are available, but these shields are tinted and can reduce visual acuity. Additional illumination of the task area might be necessary when these types of arc protective face shields are used.

(c) **Hand Protection**. Leather or FR gloves shall be worn where required for arc flash protection. Where insulating rubber gloves are used for shock protection, leather protectors shall be worn over the rubber gloves.

Note: Insulating rubber gloves and gloves made from layers of flame-resistant material provide hand protection against the arc flash hazard. Heavy-duty leather (e.g., greater than 12 oz/yd2) gloves provide protection suitable up to Hazard/Risk Category 2. The leather protectors worn over insulating rubber gloves provide additional arc flash protection for the hands. During high arc exposures leather can shrink and cause a decrease in protection.

(d) **Foot Protection**. Heavy-duty leather work shoes provide some arc flash protection to the feet and shall be used in all tasks in Hazard/Risk Category 2 and higher.

(14) Clothing Material Characteristics. FR clothing shall meet the requirements described in 7.4(C)(14)(a) through 7.4(C)(15).

(a) Melting. Clothing shall meet the requirements of ASTM F 1506, Standard Performance Specification for Textile Material for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards, and do not exhibit evidence of a melting and sticking hazard during arc testing according to ASTM F 1959. Non–flame-resistant synthetic materials, such as acetate, nylon, polyester, rayon, either alone or in blends with non–flameresistant cotton, can melt into the skin when exposed to high temperatures or aggravate the burn injury.

(b) Flammability. Clothing made from nonmelting flammable natural materials, such as cotton, wool, rayon, or silk, shall be permitted for Hazard/Risk Categories 0 and -1 considered acceptable if it is determined by flash hazard analysis that the exposure level is 8.36 J/cm2 (2.0 cal/cm2) or less, and that the fabric will not ignite and continue to burn under the arc exposure hazard conditions to which it will be exposed (using data from tests done in accordance with ASTM F 1958.)

(15) Clothing Not Permitted. Clothing made from materials that do not meet the requirements of
7.4(C)(14)(a) regarding melting, or made from materials that do not meet the flammability requirements of 7.4(C)(14)(b), shall not be permitted to be worn.

Exception: Non-melting, flammable (non-FR) materials shall be permitted to be used as under layers to FR clothing, as described in 7.4(C)(14)(a) and also shall be permitted to be used for Hazard/Risk Category 0 and -1.

(16) Care and Maintenance of FR Clothing and FR Flash Suits.

(a) Inspection. FR apparel shall be inspected before each use. Work clothing or flash suits that are contaminated, or damaged to the extent their protective qualities are

impaired, shall not be used. Protective items that become contaminated with grease, oil, or flammable liquids or combustible materials shall not be used.
(b) Manufacturer's Instructions. The garment manufacturer's instructions for care and maintenance of FR apparel shall be followed.

(D) Other Protective Equipment.

(1) Insulated Tools and Equipment. Employees shall use insulated tools and/or handling equipment when working inside the Limited Approach Boundary of exposed live parts where tools or handling equipment might make accidental contact. Insulated tools shall be protected from damage to the insulating material.
(a) Requirements for Insulated Tools. The following requirements shall apply to insulated tools:

(1) Insulated tools shall be rated for the voltages on which they are used.
(2) Insulated tools shall be designed and constructed for the environment to which they are exposed and the manner in which they are used.
(b) Fuse or Fuse Holding Equipment. Fuse or fuse holder handling equipment, insulated for the circuit voltage, shall be used to remove or install a fuse if the fuse terminals are energized.
(c) Ropes and Handlines. Ropes and handlines used near exposed live parts operating at 50 volts or more, or used where an electrical hazard exists, shall be nonconductive.
(d) Fiberglass-Reinforced Plastic Rods. Fiberglass reinforced plastic rod and tube used for live line tools shall meet the requirements of ASTM F 711, *Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used; in Live Line Tools*, 1989 (R1997).
(e) Portable Ladders. Portable ladders shall have nonconductive side rails if they are used where the employee or ladder could contact exposed live parts operating at 50 volts or more or where an electrical hazard exists. Nonconductive ladders shall meet the requirements of ANSI standards for ladders listed in NFPA 70E, Table 130.7(F).
(f) Protective Shields. Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near live parts that might be accidentally contacted or where dangerous electric heating or arcing might occur. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the live parts.
(g) Rubber Insulating Equipment. Rubber insulating equipment used for protection from accidental contact with live parts shall meet the requirements of the ASTM standards listed in NFPA 70E, Table 130.7(F).
(h) Voltage Rated Plastic Guard Equipment. Plastic guard equipment for protection of employees from accidental contact with live parts, or for protection of employees or energized equipment or material from contact with ground, shall meet the requirements of the ASTM standards listed in NFPA 70E, Table 130.7(F).
(i) Physical or Mechanical Barriers. Physical or mechanical (field fabricated) barriers shall be installed no closer than the restricted approach distance given in Table 1. While the barrier is being installed, the restrictive approach distance specified in Table 1 shall be maintained, or the live parts shall be placed in an electrically safe work condition.

7.5 Other Precautions for Personnel Activities

(A) Alertness.

(1) When Hazardous. Employees shall be instructed to be alert at all times when they are working near live parts operating at 50 volts or more and in work situations where unexpected electrical hazards might exist.
(2) When Impaired. Employees shall not knowingly be permitted to work in areas containing live parts operating at 50 volts or more or other electrical hazards while their alertness is recognizably impaired due to illness, fatigue, or other reasons.

(B) Blind Reaching. Employees shall be instructed not to reach blindly into areas that might contain exposed live parts where an electrical hazard exists.

(C) Illumination.
(1) General. Employees shall not enter spaces containing live parts unless illumination is provided that enables the employees to perform the work safely.
(2) Obstructed View of Work Area. Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform any task near live parts operating at 50 volts or more or where an electrical hazard exists.

(D) Conductive Articles Being Worn. Conductive articles of jewelry and clothing (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn where they present an electrical contact hazard with exposed live parts.

(E) Conductive Materials, Tools, and Equipment Being Handled.
(1) General. Conductive materials, tools, and equipment that are in contact with any part of an employee's body shall be handled in a manner that prevents accidental contact with live parts. Such materials and equipment include, but are not limited to, long conductive objects, such as ducts, pipes and tubes, conductive hose and rope, metal-lined rules and scales, steel tapes, pulling lines, metal scaffold parts, structural members, bull floats, and chains.
(2) Approach to Live Parts. Means shall be employed to ensure that conductive materials approach exposed live parts no closer than that permitted by Table 1.
(F) Confined or Enclosed Work Spaces. When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed live parts operating at 50 volts or more or an electrical hazard exists, the employer shall provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed live parts operating at 50 volts or more or where an electrical hazard exists.
(G) Housekeeping Duties. Where live parts present an electrical contact hazard, employees shall not perform housekeeping duties inside the Limited Approach Boundary where there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided to prevent contact.
Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicone carbide, as well as conductive liquid solutions) shall not be used inside the Limited Approach Boundary unless procedures to prevent electrical contact are followed.
(H) Occasional Use of Flammable Materials. Where flammable materials are present only occasionally, electric equipment capable of igniting them shall not be used, unless

measures are taken to prevent hazardous conditions from developing. Such materials include, but are not limited to, flammable gases, vapors, or liquids; combustible dust; and ignitable fibers or flyings.

(I) Anticipating Failure. When there is evidence that electric equipment could fail and injure employees, the electric equipment shall be de-energized unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible because of equipment design or operational limitation. Until the equipment is de-energized or repaired, employees shall be protected from hazards associated with the impending failure of the equipment.

(J) Routine Opening and Closing of Circuits. Load-rated switches, circuit breakers, or other devices specifically designed as disconnecting means shall be used for the opening, reversing, or closing of circuits under load conditions. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections shall not be permitted to be used for such purposes, except in an emergency.

(K) Reclosing Circuits after Protective Device Operation.

After a circuit is de-energized by a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses shall be prohibited. When it is determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, examination of the circuit or connected equipment shall not be required before the circuit is reenergized.

8.0 DEFINITIONS

Accessible (as applied to equipment). Admitting close approach; not guarded by locked doors, elevation, or other effective means.

Accessible (as applied to wiring methods). Capable of being removed or exposed without damaging the building structure or finish or not permanently closed in by the structure or finish of the building.

Accessible, Readily (Readily Accessible). Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, and so forth.

Attachment Plug (Plug Cap) (Plug). A device that, by insertion in a receptacle, establishes a connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle

Branch Circuit. The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

Conductor, Bare. A conductor having no covering or electrical insulation whatsoever.

Conductor, Insulated. A conductor encased within material of composition and thickness that is recognized by the NEC as electrical insulation.

Deenergized. Free from any electrical connection to a source of potential difference and from electrical charge; not having a potential different from that of the earth.

Disconnecting Means. A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

Electrical Single-Line Diagram. A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used in the circuit or system.

Electrically Safe Work Condition. A state in which the conductor or circuit part to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Enclosed. Surrounded by a case, housing, fence, or wall(s) that prevents persons from accidentally contacting energized parts.
Enclosure. The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.
Energized. Electrically connected to or having a source of voltage.
Exposed (as applied to live parts). Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.
Exposed (as applied to wiring methods). On or attached to the surface or behind panels designed to allow access
Feeder. All circuit conductors between the service equipment, the source of a separately derived system, or other power
supply source and the final branch-circuit overcurrent device.
Guarded. Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach or contact by persons or objects to a point of danger.
Insulated. Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.
Limited Approach Boundary. An approach limit at a distance from an exposed live part within which a shock hazard exists.
Live Parts. Energized conductive components.
Prohibited Approach Boundary. An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part.
Properly Trained Employee. An employee who has skills and knowledge related to the construction and operation of the
electrical equipment and installations and has received safety training on the hazards involved.
Qualified Electrical Worker. A qualified person who by reason of a minimum of two years of training and experience with high-voltage (over 600V) circuits and equipment and who has demonstrated by performance, familiarity with the work to be
performed and the hazards involved.
Qualified Person. One who has skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.
Restricted Approach Boundary. An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electrical arc over combined with inadvertent movement, for personnel working in close proximity to the live part.
Voltage (of a Circuit). The greatest root-mean-square (rms) (effective) difference of potential between any two conductors of the circuit concerned.
FPN: Some systems, such as 3-phase 4-wire, single-phase 3-wire, and 3-wire direct-current, may have various circuits of various voltages.
Voltage, Nominal. A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (e.g., 120/240 volts, 480Y/277 volts, 600 volts). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.
Voltage to Ground. For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for ungrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.
Working Near (live parts). Any activity inside a Limited Approach Boundary.
Working On (live parts). Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the personal protective equipment a person is wearing.

APPENDIX A

ENERGIZED ELECTRICAL WORK PERMIT

Work Order No

Name of Equipment:
Identification:
Fed From:
Drawing Number:

Description:
Location:

ELECTRICAL ENERGY SOURCE HAZARDS FOR THIS PERMIT
Check all that apply

☐ 120-volts	☐ 277 volts	☐ Foreign	☐ Emergency pwr
☐ 208 volts	☐ 480 volts	☐ Remote control	☐ Less than50 volts,
☐ 240 volts	☐ Other (describe):	☐ DC	permit may not be required

WORK TO BE PERFORMED (outline method):

JUSTIFICATION (Reason for equipment to remain energized, beyond LOTO identification or verification):

STOP WORK POINTS (If any unexpected energy is found, equipment has been modified since the permit issued, etc):
Description of stop work issue:

NOTE: THIS PERMIT VOID AT ANY STOP WORK POINT!

SPECIAL INSTRUCTIONS:

APPROACH BOUNDARIES TO LIVE PARTS FOR SHOCK PROTECTION (from NFPA-70E, Table 130.2 (C)

SYSTEM VOLTAGE:	LIMITED APPROACH (Fixed circuit parts)* DISTANCE	RESTRICTED APPROACH DISTANCE	PROHIBITED APPROACH DISTANCE
☐ less than 50 volts	☐ Not spec'd	☐ Not spec'd	☐ Not spec'd
☐ 50 to 300 volts	☐ 3' 6"	☐ avoid contact	☐ avoid contact
☐ 301 to 750	☐ 3' 6"	☐ 1' 0"	☐ 0' 1"
☐ 751 to 15 kV	☐ 5' 0"	☐ 2' 2"	☐ 0' 7"
☐ 15.1 kV to 36 kV	☐ 6' 0"	☐ 2' 7"	☐ 0' 10"

SACRAMENTO STATE
Office of Environmental Health & Safety

Electrical Safety Program

FLASH HAZARD ANALYSIS (fromNFPA-70E, 130.3 (A))

Fault Clearing Device: (name): (description)
Mfgr's Model or type number:
Clearing time, seconds:

Flash Protection Boundary *
(Check the method used)
☐ 4.0 feet (systems less than 600 volts, with 0.1-sec clearing time, Ibf < 50 kA, or 5000 A-sec)
☐ Other: please state the source or attach the work performed to derive the boundary.

HAZARD/RISK LEVEL

Hazard/Risk Level: ☐–1 ☐ 0 ☐ 1 ☐ 2 ☐2* ☐ 3 ☐ 4
At a distance of_____

PERSONAL PROTECTIVE EQUIPMENT

		Cal Rating	
Cal Rating			
☐ Natural fiber clothing	☐ FR long sleeve shirt	_____	☐ FR Flash suit pants
☐ Eye protection	☐ FR Pants	_____	☐ FR Hard hat
☐ Tee shirt (short)	☐ FR Coverall	_____	☐ FR Safety goggles
☐ Pants	☐ FR Jacket	_____	☐Arc-rated face shield
☐ Long sleeve shirt	☐ FR Flash suit jacket	_____	☐ Flash suit hood

BARRIERS:
☐ Locked access
☐ Barrier tapes, stanchions
sign
☐ Other:

WORKER SUPPORT REQUIRED:
[X] Safety Watch Required
☐Other (describe task): ☐ Electrical Hazard

WORK SCHEDULED: Date: Hours:
Permit expires: Date: .
Signatures are not required until the work briefing is complete

Qualified Person	**Qualified Person**	**Supervisor or designee**
(performing work): ☐	(performing work): ☐	
Safety Watch ☐	Safety Watch ☐	
Reviewed Hazard Analysis	Reviewed Hazard Analysis	
Initials: _____	Initials: _____	☐Prepared Hazard Analysis
☐ Completed job briefing	☐Completed job briefing	☐ Completed job briefing
☐ Agree to requirements	☐Agree to requirements	
Name:	Name:	Name:
Signature:	Signature:	Signature:
_____	_____	_____
Date:_____	Date:_____	Date:_____

Electrical Safety Program

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